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CODER-DECODER

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CODER-DECODER

[Fugo-ka shingo-ka sochi]

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Claims

1. Coder-decoder characterized as being equipped with multiple coding algorithm storage means for storing coding algorithms,
multiple decoding algorithm storage means for storing coding [sic; decoding] algorithms,
an information transmission means for transmitting information constituting the aforementioned decoding algorithm from a transmitter to a receiver, and

multiple decoding algorithm decision means for determining the aforementioned decoding algorithm based on the aforementioned information.

2. Coder-decoder described under Claim 1 and characterized in that the coding algorithm storage means are configured with multiple RAMs for storing DPCM coding tables, the decoding algorithm storage means are configured with multiple RAMs for storing DPCM decoding tables, the information transmission means is a means for dividing a required decoding table corresponding to the coding table into separate sync blocks and further adding an identification code before transmission, and the decoding algorithm decision means is a means for detecting the aforementioned identification code in order to identify the data in the aforementioned decoding table.

Detailed explanation of the invention

Industrial application field

The present invention pertains to a coder-decoder; particularly, to a coding-decoding system in a system in which a coding code is transmitted.

Prior art

Conventionally, when transmitting images and audio information digitally, there have been various kinds of coding schemes in order to reduce the amount of data to be transmitted.

An example of the aforementioned coding schemes is predictive (differential) coding (Differential Pulse Code Modulation; referred below to as DPCM), in which correlation between adjacent sampled values is used to compress information size. /2*

DPCM is well-known and in this method, a coded sampled value is decoded first, said decoded value is used to obtain a predicted value for the sampled value to be coded next, and the difference between said predicted value and the actual value is quantized for coding.

Figure 4 is a diagram showing the configuration of a transmission system in which a ROM table is used for the configuration of the DCPM [sic] of a conventional example.

In Figure 4, first, with respect to the transmitter's side, (301) represents a terminal into which the sampled value is input, (302) represents a ROM for storing data obtained through the tabulation of computations required for DPCM processing, and (303) represents a predictor made of a D flip-flop in the figure. The sampled value input into the input terminal (301) and the

* [Editor's note: Numbers in right margin represent pagination of original foreign language document.]

predicted value output from the predictor (303) are supplied into the address input of the ROM (302). That is, input of the sampled value and the predicted value constitutes an address signal for the ROM (302). The ROM (302) outputs a DPCM code into a sync/ID code adding circuit (304), and a locally decoded value to the predictor (303), according to said address signal. A sync code and an ID code are added to the DPCM code at the sync adding circuit (304) and transmitted from an output terminal (306) into the transmission channel via a modem (305).

Next, with respect to the receiver's side, first, the signal transmitted from the transmitter's side is input into an input terminal (307) and then to a sync/ID code separation circuit (309) via a modem (308) for sync code/ID code separation. (310) represents a ROM which constitutes a decoding table, and the DPCM code output from the aforementioned sync/ID code separation circuit (309) and a predicted value to be described later are input as its address input. Then, when the DPCM code and the predicted value are input, the ROM (310) outputs the corresponding decoded value in the table into an output terminal (312) at the memory access time. The decoded value output from the ROM (310) is also applied to a predictor (311) configured with a D flip-flop. Output of the predictor is applied to the ROM (310) as a predicted value.

Said table in the ROM (310) is decided in correspondence to the table in the ROM (302) on the aforementioned transmitter's side.

Problems to be solved by the invention

However, the aforementioned conventional example has problems 1 through 3 described below.

(1) When an improvement/change is made to the coding table on the transmitter's side, an improvement/change needs to be added to the decoding table on the receiver's side accordingly, which requires the ROMs (302) and (310) that comprise the decoding table to be replaced.
(2) According to the aforementioned problem 1, if suitable changes are made to the coding table and the decoding table, when transmitting multiple image program sources with different S/Ns, for example, it is almost impossible to replace the ROMs that comprise the coding/decoding table simultaneously and quickly for each source in an attempt to use the optimum algorithm (that is, a minimum coding table) for the transmission of each source.
(3) Although it may be possible that ROMs corresponding to the respective coding and decoding tables are made available in advance in order to solve the aforementioned problems 1 and 2, neither of the aforementioned methods is efficient when switching is required between many tables, when there are more receivers than transmitters, and when the distance between a transmitter and a receiver is great.

The present invention was made in order to solve the aforementioned problems, and its purpose is to configure a coder-decoder by which change of algorithm can be made extremely easily without interrupting the flow of the signal being transmitted, and that changes needed by the receiver's side can also be made by the transmitter's side.

Means to solve the problems

According to the present invention, a coder-decoder equipped with multiple coding algorithm storage means for storing coding algorithms, multiple decoding algorithm storage means for storing coding [sic; decoding] algorithms, an information transmission means for transmitting information constituting the aforementioned decoding algorithm from a transmitter to a receiver, and multiple decoding algorithm decision means for determining the aforementioned decoding algorithm based on the aforementioned information is used in order to achieve the aforementioned objective. /3

In addition, in the aforementioned invention, a coder-decoder in which the coding algorithm storage means are multiple RAMs for storing DPCM coding tables, the decoding algorithm storage means are multiple RAMs for storing DPCM decoding tables, the information transmission means is a means for dividing a required decoding table corresponding to the coding table into separate sync blocks and further adding an identification code before transmission, and the decoding algorithm decision means is a means for detecting the aforementioned identification code in order to identify the data in the aforementioned decoding table is used in order to achieve the aforementioned objective.

Function

In the coder-decoder of the present invention, the coding algorithm is stored by means of multiple coding algorithm storage means, the decoding algorithm is stored by means of multiple decoding algorithm storage means, information constituting the aforementioned decoding algorithm is transmitted from a transmitter to a receiver by means of a information transmission means, and the aforementioned decoding algorithm is decided by means of multiple decoding algorithm decision means based on the aforementioned information.

Application examples

The coder-decoder of an application example of the present invention will be explained below in reference to figures.

Figure 1 is a diagram showing the configuration of the transmitter of the coder-decoder (referred to below as the present device) of an application example of the present invention. Figure 2 is a diagram showing the configuration of the receiver of the present device of said application example. Figure 3 is a diagram showing the types of data transmitted in said application example; wherein, Figure 3(a) shows a condition in which the table containing the decoded value for DPCM is added to the data to be transmitted, Figure 3(b) shows a condition in which the table data is contained in the ID code for transmission, and Figure 3(c) shows a condition in which the entire table data is transmitted only initially.

In Figures 1 and 2, (A) represents coding algorithm storage means configured with multiple RAMs (Random access memory) (109) and (111), which serve as means for storing coding table containing coding algorithm for DPCM (mentioned above). (B) represents decoding algorithm storage means configured with multiple RAMs (133) and (135) (Figure 2), which serve as means for storing decoding table containing decoding algorithm for DPCM. (C) represents an information transmission means configured with a sync/ID adding circuit (113), which serves as a means to transmit information constituting the decoding algorithm (to be described later) from the transmitter to the receiver (receiving side); wherein, the means is used to divide a required coding table into scattered sync blocks and add an identification code for transmission. (D) represents a decoding algorithm decision means configured with a system control part (124) (Figure 2), which serves as a means to decide the aforementioned decoding algorithm based on the information from the aforementioned information transmission means (C); wherein, the means is used to detect the aforementioned identification code in order to identify the aforementioned decoding table data.

First, loading of a coding table by the coder and loading of a decoding table by the decoder will be explained using Figures 1 and 2.

In Figure 1, after the power is turned on, a loading signal is applied from a system controller (117).

In response, a storage device (106) loads a DPCM coding code, which is a DPCM specific computation, and a DPCM table containing a locally decoded value into the respective RAMs (109) and (111) in sequence.

The RAMs (109) and (111), into which the aforementioned DPCM table is loaded, can be selected by switching a switch (105).

Although either RAM (109) or (111) may be used, the DPCM table is loaded here into the RAM (109) first.

Furthermore, the DPCM table that is loaded first is for the image data that is transmitted first.

Next, procedures for transmitting the decoding table corresponding to the aforementioned coding table from the transmitter to the RAMs (133 and 135 in Figure 2) on the decoder's side (receiver's side) will be explained in reference to Figure 1. /4

In the decoder (transmitter's side) in Figure 1, (101) is a terminal into which a sampled value of an image signal and an audio signal is input; (104) is a switch for selecting a RAM, that is, for selecting a coding code (in this case, 109 is selected); (109) is the RAM into which DPCM coding code is loaded as described above; and (108) is a D flip-flop. The sampled value input into the input terminal (101) and the predicted value output from the D flip-flop (108) are supplied to the address input of the RAM (109). That is, input of the sampled value and the predicted value constitutes an address signal for the RAM.

The RAM (109) outputs the DPCM code to a terminal (112a) of the multicontact switch, and the locally decoded value to the D flip-flop (108) according to the address signal comprising the aforementioned input of the sampled value and the predicted value. The DPCM code output from the RAM (109) is sent through a multicontact switch (113) to a modem (114) after sync and ID codes are added by (113) and sent out to the transmission channel from a terminal (115).

Furthermore, although the aforementioned storage device (106) and storage device (107), which will be described later, may be slow in terms of access time, they are sufficient as long as they have a storage capacity large enough to store the DPCM table. Otherwise, a magnetic recording/reproducing device, such as a magnetic disk device or EPROM, may be used, or it is also possible to use an external storage device.

In addition, instead of transmitting the decoding table from the storage device (107), a counter may be added in order to transmit the decoding table by switching the RAM addresses that point to the coding table to the counter.

On the other hand, a loading signal is applied to the aforementioned storage device (107) from the system controller (117) (Figure 1). In response, the storage device (107) outputs the table containing the decoded value for DPCM into the sync/ID adding circuit (113) in sequence. Said table containing the decoded value for DPCM corresponds to the DPCM coding code on the coder's side and the DPCM table (RAM (109)) containing the locally decoded value and is used for the decoding of the DPCM code on the receiver's side.

Like the ID code, said table containing the decoded value for DPCM is added in sequence as an additional code at the sync/ID adding circuit (113).

In the present application example, the table data is divided and added in such a way that they match the type of data, such as an image signal or an audio signal, that is transmitted.

In Figure 3(a), the table containing the decoded value for DPCM is added to the data, such as image signal or an audio signal, that is transmitted; wherein, the table is divided and

distributed over respective data (respective sync blocks) for transmission. As shown in Figure 3(b), the table data may be included in ID codes for transmission.

Furthermore, because the power has already been turned on in this case, either a temporary image signal for testing is used to transmit the table containing the decoded value for DPCM, or the entire table data may be transmitted only initially (Figure 3(c)).

The transmission data containing the decoding code output from the sync/ID adding circuit (113) is sent to the modem (114), where it is converted into a signal suitable for the transmission channel and sent out to the transmission channel from the terminal (115).

Next, the loading of the table containing the decoded value for DPCM from the transmitter to the receiver (decoder) will be explained using Figure 2.

Figure 2 shows the configuration of the decoder on the receiver's side.
In Figure 2, the data, which contains the table containing the DPCM decoding code, transmitted through the transmission channel is input into an input terminal (121), sent through a modem (122), and input into a sync/ID code separation circuit (123).

Here, SYNC portion in the data is sent to the system control part (124) in order to achieve the synchronization of the entire system.

In addition, whether table data has been added or not is determined based on a code provided in the ID code to indicate whether table data is present or not. In this case, because table data is added, a judgment is made accordingly. Then, the ID code is read to decide into /5
which RAM the table data is written.

Here, the table containing the decoded value for DPCM is loaded into the RAM (135).

Therefore, the image information and the audio information are sent to a switch (126), and the table containing the decoded value for DPCM extracted from the ID code is sent to a switch (125).

The table containing the decoded value for DPCM sent to the switch (125) is loaded into the RAM (135) in sequence.

At this time, a control signal for loading the table data is input into the RAM (135) from a counter (127) via the multicontact switches (131) and (132). The counter (127) generates an address signal for the RAM (135) at the timing based on the SYNC data input into the system control part.

Furthermore, similarly, it is also possible to have a table different from the aforementioned DPCM decoding table loaded into the RAM (133).

Loading of the coding table into the coder and loading of the decoding table into the decoder after the power is turned on are now completed in the aforementioned manner.

Next, based on the aforementioned initialization, flow of the data on image information and audio information, the DPCM table containing the DPCM coding code and the locally

decoded value, and the table containing the decoded value for DPCM will be explained using Figures 1 through 3.

First, flow on the transmitter's side (coder's side) will be explained using Figure 1.

In Figure 1, as it has been described above, the sampled value is input through the terminal (101), and the switch (104) makes a selection between the RAMs (109) and (111).

Here, the RAM (109) is assumed to have been selected.

As described above, (108) and (110) are both D flip-flops.

As described above, the sampled value input and the predicted value output from the D flip-flop are supplied into the address input of the RAM (109). That is, input of the sampled value and the predicted value constitutes an address signal for the RAM. Furthermore, as described above, the coding code table has been loaded into the RAM (109).

The RAM (109) outputs the DPCM code into the terminal (112) of the multicontact switch, and the locally decoded value to the D flip-flop (108), according to the address signal comprising the sampled value and the predicted value.

On the other hand, the DPCM code output from the RAM (109) is sent through a multicontact switch (112) to the modem (114) after sync and ID codes are added by the sync/ID adding circuit (113) and output to the transmission channel. The data to be transmitted comes in the forms shown in Figure 2(a), (b), and (c) as has already been mentioned above.

In addition, because the same operation occurs when the RAM (111) is selected, the explanation will be omitted.

Next, flow on the receiver's side (decoder's side) will be explained using Figure 2. In Figure 2, the signal transmitted through the transmission channel is input into the input terminal (121), sent through the modem (122), and input into the sync/ID code separation circuit (123) where the sync signal is separated. The SYNC portion in the data transmitted is sent directly to the system control part (124) in order to achieve the synchronization of the entire system.

In addition, whether a table data has been added or not is determined based on a code provided in the ID code that indicates whether table data is present or not. Then, the RAM containing the decoding table corresponding to the coding table is selected according to the ID code.

The result is sent to the system control part indicated by (124) in order to switch the respective multicontact switches (125), (126), (129), (130), (131), (132), (137), (138), and (139) via a multicontact switch controller (128). In this case, because the decoding table corresponding to the coding table (109) has been loaded into RAM (133), RAM (133) is selected. The image data output from the sync/ID code separation circuit (123) is led to the RAM (133), which comprises the DPCM decoding table, through respective multicontact switches (126), (126a), (129a), and (129). The aforementioned DPCM code and the predicted value from a D flip-flop

(134) to be described later are input as an address input to said RAM (133). /6

When the aforementioned DPCM code and the predicted value are input, the RAM (133) outputs the corresponding decoded value in the table loaded into an output terminal (140) through respective switches (137), (137b), (139a), and (139).

The decoded value output from the RAM (133) is also applied to the D flip-flop (134). Output of the D flip-flop (134) is applied as a predicted value to the RAM (133) via switches (130a) and (130). Furthermore, as described above, the decoding code table corresponding to the coding code table has already been loaded into the aforementioned RAM (133).

The flow of operation after the power is turned on has been explained above.

In the above flow in the present application example, the RAMs provided with the coding code table and the decoding code table make up 2 systems, namely, RAM (109)-RAM (111) and RAM (133)-RAM (135), during the normal operation of the device. Also, the data on the decoding table can be divided and distributed over the ID codes in the sync blocks, which do not affect the data, such as image information and audio information. Therefore, the coding code table and the decoding code table on the unused side can be rewritten without affecting the image information and the audio information being transmitted.

Therefore, transmission can be carried out using algorithms suitable for the respective transmission programs without interrupting the transmission programs in order to change the coding code table and the decoding code table.

What is more, entire changes can be carried out on the transmitter's side.

Furthermore, in the aforementioned application example, although the tables on the transmitter's side and the receiver's side were each configured with 2 RAMs, the present invention is not limited to this in that several RAMs may be used for the configuration.

By doing so, the switching of algorithms can be achieved at a shorter interval.

Furthermore, in the present application example, any algorithm, regardless of its complexity, can be achieved using the same circuit configuration by simply renewing the content of the DPCM table as long as the input/output characteristics of coding computation are clear, and as long as the input bit size is identical to that of the output bit. In addition, because the tables are configured with SRAMs, change of algorithms is extremely easy; for example, when magnetic disk devices are used for the storage devices (106) and (107), algorithms can be changed simply by replacing the disks. Furthermore, because the storage devices may have slow access time, inexpensive large-capacity storage devices, such as magnetic disk devices, can be used, allowing many algorithms to be set.

Furthermore, although the aforementioned application examples were exemplified using initial value prediction for DPCM, it is obvious that the present invention is not limited to this and can be applied also to a coding system and a decoding system using DPCM for 2D

prediction, 3D prediction, and adaptive prediction as well as to other coding/decoding systems in which code lengths are decided arbitrarily.

Furthermore, although SRAMs are used as the RAMs in the aforementioned application examples, DRAMs may be used provided that refresh and access time conditions are met.

Effect of the invention

As it has been explained above, the present invention allows to configure a coder-decoder capable not only of making it extremely easy to change algorithms without interrupting the flow of signals being transmitted but also of enabling the transmitter's side to handle everything, including the changes required on the receiver's side.

Brief explanation of the figures

Figure 1 is a diagram showing the configuration of the transmitter of an application example of the present invention. Figure 2 is a diagram showing the configuration of the receiver of said application example. Figure 3 is a diagram showing the types of the data transmitted in said application example; wherein, Figure 3 (a) shows a condition in which the table containing the decoded value for DPCM is added to the data to be transmitted, Figure 3 (b) shows a /7
condition in which [the table data] is contained in the ID code for transmission, and Figure 3 (c) shows a condition in which the entire table data is transmitted only initially. Figure 4 is a diagram showing the configuration of a transmission system in which a ROM table is used for the configuration of the DPCM of a conventional example.

A. coding algorithm storage means
B. decoding algorithm storage means
C. information transmission means
D. decoding algorithm decision means
101. sampled value input terminal
109, 111. RAM
108, 110. DF/F
113. sync/ID adding circuit
106, 107. storage device
115. output terminal
121. input terminal
123. sync/ID code separation circuit

133, 135. RAM

134, 136. DF/F

140. output terminal

In the figures, the same symbols indicate the identical parts or the equivalents.

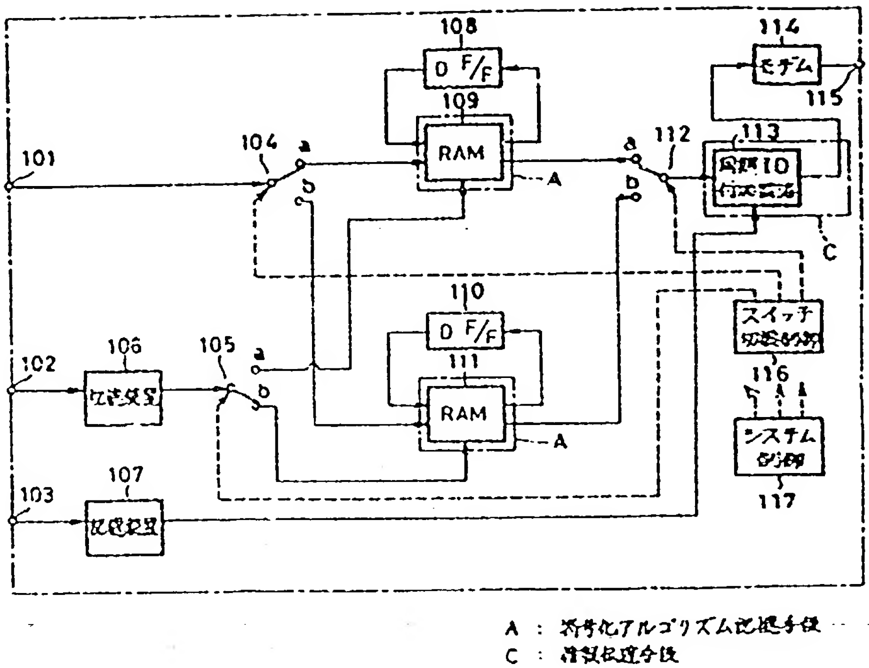

Figure 1. Diagram of the configuration of the transmitter of an application example of the present invention

Key: A Coding algorithm storage means
C Information transmission means
106, 107 Storage device
113 Sync/ID adding circuit
114 Modem
116 Switch multicontact control part
117 System controller

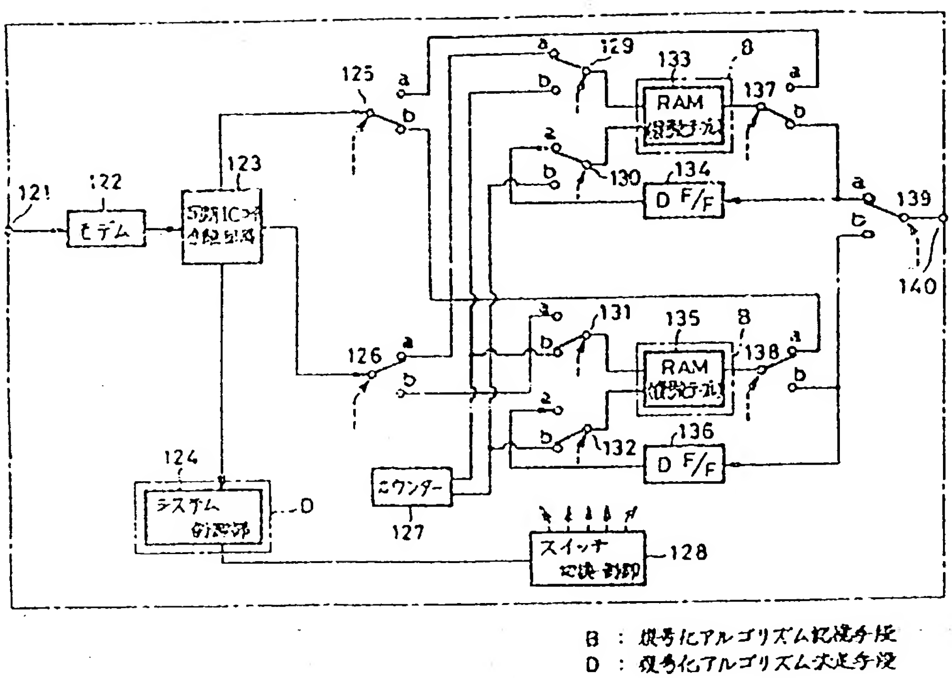

Figure 2. Diagram of the configuration of the receiver of the application example

Key:
- B Decoding algorithm storage means
- D Decoding algorithm decision means
- 122 Modem
- 123 Sync/ID code separation circuit
- 124 System control part
- 127 Counter
- 128 Switch multicontact control
- 133, 135 RAM (decoding table)

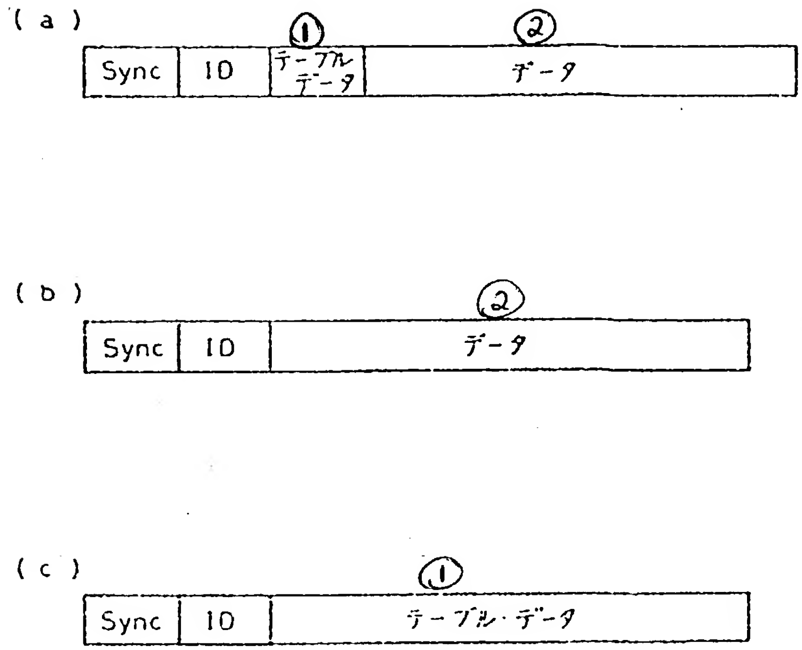

Figure 3. Diagram showing the transmission data types in the application example

Key:
1 Table data
2 Data

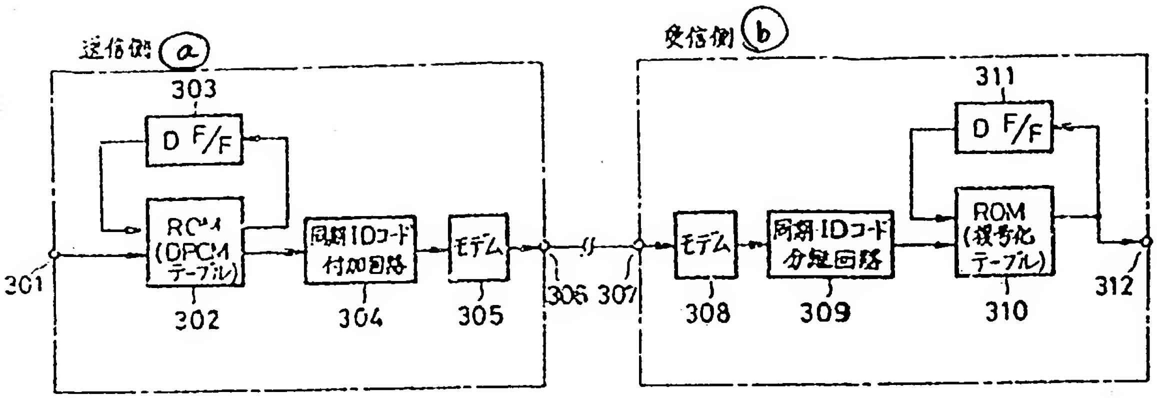

Figure 4. Diagram showing the configuration of a transmission system in which a ROM table is used for the configuration of the DPCM of an conventional example

Key:

a	Transmitter's side
b	Receiver's side
302	ROM (DPCM table)
304	Sync/ID code adding circuit
305, 308	Modem
309	Sync/ID code separation circuit
310	ROM (decoding table)